Group S-1 §903.2.9

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for storage of upholstered furniture or mattresses >2,500 ft²
  - The storage of commercial trucks or buses when the fire area is >5,000 ft²

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Group S-1 Repair Garages §903.2.9.1

- Fire sprinklers required throughout the building when one of the following conditions exist:
  - Building is 1 story ***and*** fire area >12,000 ft²
  - Building is ≥ 2 stories ***and*** fire area >10,000 ft²
  - Repair garage is located in a basement
  - Repair garage for commercial trucks or buses and the fire area is >5,000 ft²

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Group S-1 Storage of Tires §903.2.9.2

- Fire sprinklers required when:
  - Fire area >20,000 cubic feet

Would this be considered high-piled combustible storage?

IFC

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Group S-2 Enclosed Parking Garage §903.2.10

- Fire sprinklers required when :
  - Fire area >12,000 ft²
  - Parking garage is located beneath another occupancy

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Basements and Stories without Openings §903.2.11.1

- Fire sprinklers required on every story, including basements, where floor area >1,500 ft² ***UNLESS***:
  - Openings are provided on at least wall with 1 opening within each 50' of wall, and
  - Openings are separated ≤50'
  - Travel distance to exterior openings ≤75'
  - Each opening has minimum dimension ≥30"

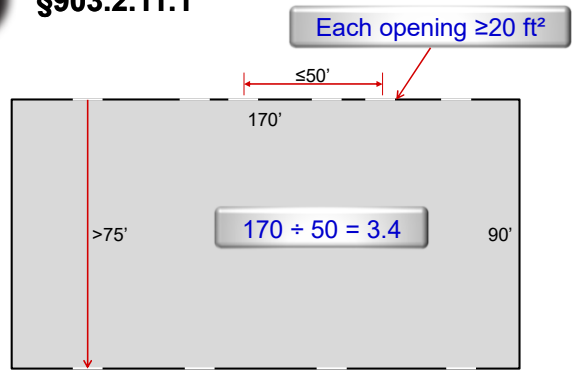
• Frequently applied to basements
• Also applies to above grade stories

109

FOR EXAMPLE

Basements and Stories without Openings §903.2.11.1

Each opening ≥20 ft²



110

Buildings ≥55' in Height §903.2.11.3

- Fire sprinklers required in buildings having a story ≥55' above the LLFDVA with OL ≥30

111

Other Hazards §903.2.11.4

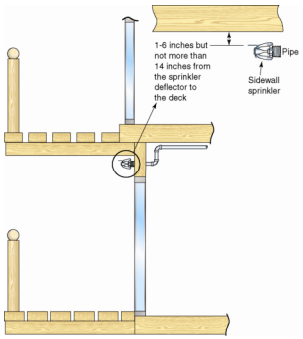
- Fire sprinkler required in hazardous exhaust ducts with a diameter ≥10"
- If used for conveying a corrosive atmosphere, sprinklers must be listed for the atmosphere
- Listed flexible hose sprinklers are special sprinklers with pressure & flow calculated in accordance with NFPA 13, §11.2.3.4.3

Photograph courtesy of Flexhead Inc.

112

Balconies and Decks §903.3.1.2.1

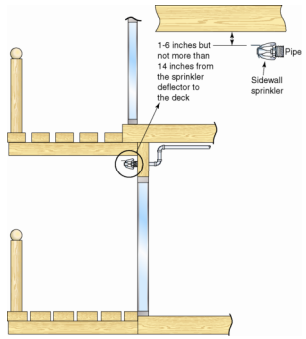
- Addition to NFPA 13R
- Fire sprinklers required on balconies, decks and patios in Type V construction with a roof or deck above
- The sprinklers must be installed 1" – 6" below a structural member and ≤14" below the deck above



113

Balconies and Decks §903.3.1.2.1

- Exterior balconies, decks and ground floor patios of dwelling units and sleeping units are constructed in accordance with Section 705.2.3.1, Exception 3 of the *International Building Code*.



114

Sprinkler Protection of Group R Attic Spaces §903.3.1.2.3

In buildings of Type III, IV or V construction that are designed under the special provisions for pedestal buildings, attics not otherwise required to be sprinklered are now further regulated if the roof assembly is located more than 55 feet above the lowest level of fire department vehicle access. Where such a pedestal building condition exists, the attics shall be:

Provided with sprinkler protection, or Constructed using noncombustible construction, or Constructed using fire-retardant-treated wood, or Filled with noncombustible insulation. The required conditions are generally consistent with those previously established for Group R-4, Condition 2 occupancies.

115

Sprinkler System Supervision §903.4

- Water-flow switches, pressure switches and valves that control the water supply for a fire sprinkler system must be electrically supervised
- 7 exceptions

1. 1- & 2-family dwellings
2. Limited area sprinkler systems
3. NFPA 13R sprinkler systems with a common supply for both domestic and sprinkler water with no shutoff
4. Jockey pump control valves
5. Control valves sealed or locked in the open position
6. Valves controlling the fuel supply
7. Trim valves sealed or locked in the open position

116

Sprinkler System Alarm Signals §903.4.1

- Alarm signals must be sent to:
  - Supervising station, or
  - Constantly attended location

What does "constantly attended" mean?

Photo courtesy of Property Protection Inc.

117

Sprinkler Systems §903.4

- An approved audible device shall be provided for each sprinkler system and located on the exterior of the building
- Floor control valves are on each riser on each floor in high-rise buildings

118

Fire Department Connection §912

- Street side of building
- 3' access around FDC
- Location approved by FCO
- Approved fi
- Labeled
- Visible from
  OR signs d

119

ACTIVITY

Automatic Sprinkler Requirements

- How many patients must be rendered incapable of self-preservation before an automatic sprinkler system is required in an ambulatory care facility located on the grade plane of a building?

4
§903.2.2

120

ACTIVITY

Automatic Sprinkler Requirements

2. Which of the following occupancy groups does not require automatic sprinkler protection throughout a building regardless of size?
   A. Group S-1
   B. Group R-2
   C. Group H-5
   D. Group I-2

121

ACTIVITY

Automatic Sprinkler Requirements

3. T F When sprinklers are required to be installed throughout the entire building, this means that the system must be designed to NFPA 13.

4. What is the minimum sprinkler discharge density and design area for a Group H-4 occupancy?

Ordinary Hazard Group 2 over 3,000 ft²
§5004.5

122

123

Fire-extinguishing Systems §904

- The following suppression types of fire-extinguishing systems are recognized:
  - Dry chemical
  - Wet chemical
  - Carbon Dioxide (CO2)
  - Halon
  - Clean agent
  - Aqueous film forming foam
  - Water mist

124

Flammable Liquid Containment Dike AFFF Flooding System

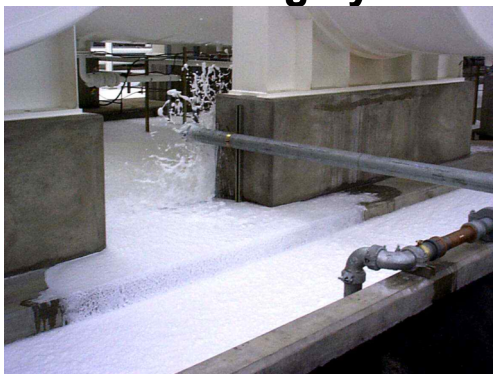


Photo courtesy of International Code Consultants, Inc.

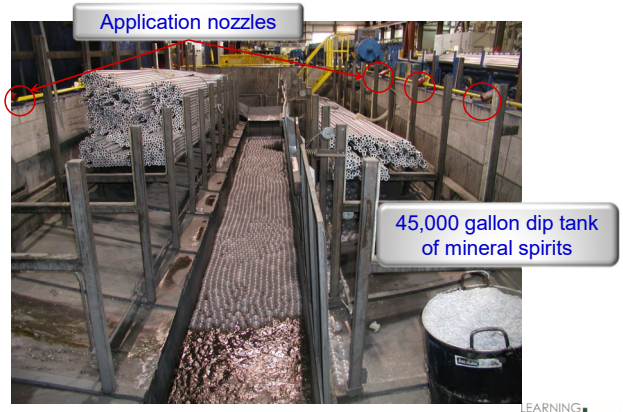
125

Design and Acceptance Testing Considerations for AFES

- Is the selected agent compatible with the hazard being protected?
- Is the system pre-engineered or an engineered design?
- Is the system a local application or total flooding design?
- If applicable, what is the integrity of the enclosure as it relates to air movement and infiltration?
- Is the amount of agent adequate to protect the largest hazard?

126

CO2 Automatic Fire-extinguishing System



127

Fire-extinguishing Systems §904.2

2018 IFC
§904.2
§904.2.1
Page 113

904.2 Where permitted. Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official.

904.2.1 Restriction on using automatic sprinkler system exceptions or reductions. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed for automatic sprinkler systems or by other requirements of this code.

128

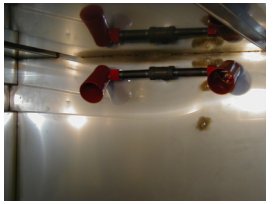
Installation Requirements for Automatic Fire-extinguishing Systems

- Systems must be designed to automatically activate
- For agents which pose a health hazard, alarm signals shall warn occupants when the system is in the process of beginning to discharge
- For buildings also equipped with a fire alarm system, the AFES must be monitored by the fire alarm system
- Where the AFES system requires notification devices, they must be audible and visual

129

Inspection and Testing of Automatic Fire-extinguishing Systems

- Prior to an acceptance test, the following elements to be inspected:
  - Confirm the design is consistent with the hazard being protected
  - Placement and location of detection devices, discharge nozzles, alarms and manual means of activation
  - Signs and operating instructions for the system



130

Dry-chemical Fire-extinguishing Systems

- Dry-chemical AFES can be engineered or pre-engineered fire suppression systems designed to protect a specific hazard or ca used for total flooding protect

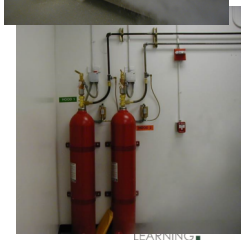
- Flammable and combustible liquids
- Flammable gases
- Combustible solids, such as plastics and ordinary combustibles

6-month inspection and testing of:
- Detection and releasing devices
- Alarms (where required)
- Verification that a sufficient volume of agent is available for the protected hazard

131

Carbon Dioxide (CO2) Fire-extinguishing Systems

- CO_2 systems can be designed for local application, total flooding or hand hoselines using NFPA 12
- Systems can be engineered or pre-engineered
- Inspected and tested every 6 months
- High-pressure cylinders must be weighed every 6 months to ensure a sufficient amount of agent is available
- Hoses and auxiliary equipment must be inspected annually



132

Halon Fire-extinguishing Systems

- Manufacturing of halons has been prohibited in the U.S. since 1994 Montreal Protocol
  - Halons are chlorinated or fluorinated hydrocarbons
  - Excellent extinguishing agents
  - Ozone-depleting chemicals
- New systems using existing stockpiles of halon are permitted
- Inspected annually including cylinders, hoses and releasing components
  - Hoses require a test every 5 years

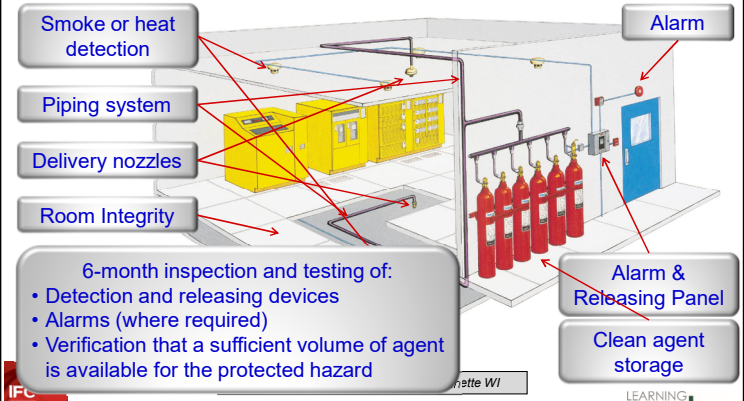
133

Clean Agent Fire-extinguishing System

- A Clean Agent is defined as an "*Electrically non-conducting, volatile or gaseous fire-extinguishant agent that does not leave a residue upon evaporation.*"
- Clean agents are available in two formulations:
  - Halocarbons – formulated from organic compounds and fluorine, chlorine, bromine or iodine
  - Inert gas – formulated from nitrogen, argon, helium or neon. CO2 may be used as a secondary agent
- All the agents are liquefied compressed gases

134

Typical Design for a Clean Agent System Protecting a Computer Room



135

Water Mist Fire Protection Systems §904.11

- Systems designed in accordance with NFPA 750
- The systems are either pre-engineered or engine- driven
- Water a limited water ry contai

NFPA 750 §3.3.19: A water spray for which the *Dv0.99*, for the flow-weighted cumulative volumetric distribution of water droplets, is less than 1,000 microns at the minimum design operating pressure of the water mist nozzle.

136

Water Mist Fire Protection Systems

- 5-outlet water mist fire-extinguishing system designed to protect engine test cells

137

Water Mist Fire Protection Systems

- Water mist test on a hydrocarbon pool fire

Photograph courtesy of Securiplex LLC

138

Commercial Cooking Systems §904.12

- Commercial cooking systems shall be protected using:
  - Wet chemical listed to UL 300; or
  - Dry chemical listed to UL 300; or
  - Automatic sprinkler system listed for this application
- These systems must be installed in accordance with their listing and the manufacturer's installation instructions

Photo courtesy of Ansul Incorporated

139

Commercial Cooking Appliances

REFER TO CODE BOOK

2018 IFC §202 Page 22

- Commercial cooking appliances defined:

Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

140

Wet-Chemical Fire-extinguishing Systems

- These systems are installed in accordance with NFPA 17A, *Wet Chemical Extinguishing Systems*
- These systems must be listed to UL 300, *Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas*

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Wet-Chemical Fire-extinguishing Systems

- Wet-chemical fire-extinguishing system protecting a Type I single island cooking hood

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Wet-Chemical Fire Extinguishing System

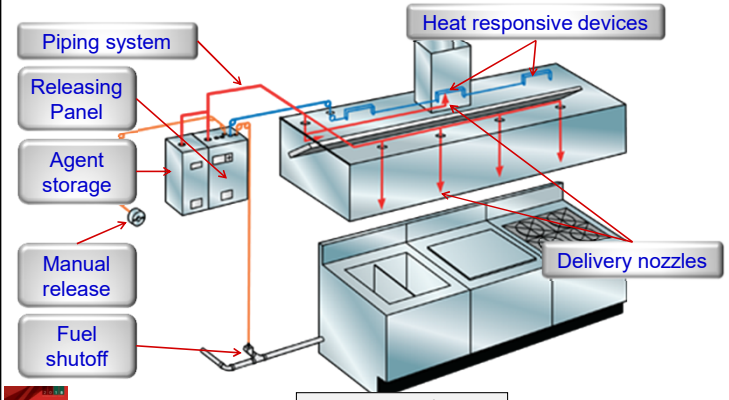

Illustration courtesy of Ansul Inc.

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Kitchen Hood Suppression

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Inspection of Commercial Hoods

Table 607.3.3.1
Commercial Cooking System Inspection Frequency

Type Of Cooking Operation	Frequency of Inspection
High-volume cooking operations such as 24-hour cooking, charbroiling or wok cooking	3 months
Low-volume cooking operations such as places of religious worship, seasonal businesses and senior centers	12 months
Cooking operations utilizing solid-fuel burning cooking appliances	1 month
All other cooking operations	6 months

Photo courtesy of Flue Steam, Inc.

145

Portable Fire Extinguishers for Commercial Cooking Operations

- §906.4.2 requires portable fire extinguishers for commercial cooking systems
  - Listed Type K extinguisher
  - Travel distance ≤30'
  - Solid fuel appliances
    - One 2.5 gallon, or two 1.5 gallon
  - Deep fat fryers
    - One 1.5 gallon for 4 fryers, ≤80 lbs each
    - See manufacturer's instructions for fryers >6 ft²

Photo courtesy of Amerex Inc.

146

Poll Question

- Question #7: A Class K Fire Extinguisher is the only fire extinguisher allowed within the kitchen area?
- Question - #8: When should a Class K Fire Extinguisher be used?

147

ACTIVITY

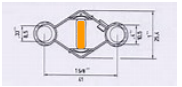
Fire-extinguishing Systems

- Can a dry-chemical fire-extinguishing system be used to increase the allowable height of a building?

  NO
  §904.2.1

- How often must frangible bulb fusible links in a Type I hood be replaced?

  After activation
  §904.12.5.3, Exception



148

ACTIVITY

Fire-extinguishing Systems

3. Which alternative fire-extinguishing agent does not leave residue once it evaporates?
   a. Dry chemical
   b. Wet chemical
   c. Aqueous film forming foam
   d. Clean agent

149

ACTIVITY

Fire-extinguishing Systems

4. What type of portable fire extinguisher is required for the protection of commercial cooking operations?
   a. Class B
   b. Class C
   c. Class D
   d. Class K

150

151

Standpipe Systems §905.3.1

- Standpipes required in:
  - ≥ 4 above or below grade plane.
  - Buildings with a floor level >30’ above LLFDVA
  - Buildings with a floor level >30’ below HLFDVA
  - Group A with OL >1,000
  - Covered & open malls
  - Stages >1,000 ft²
  - Underground buildings
  - Marinas and boatyards

152

Standpipe Systems §202

- Standpipes are classified as follows:
  - Class I: designed for FD use only
  - Class II: designed for use by building occupants
  - Class III: designed for use by FD or building occupants

2½" hose connections

1½" hose connections with hose and nozzle

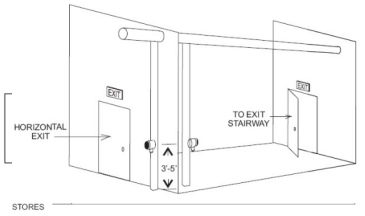
Combination of 2½" connections PLUS 1½" hose connections with hose and nozzle

153

Location of Class I Hose Valves §905.4

- In stair shafts, hose valves are required at main floor landings unless otherwise approved by the FCO
- On each side of a horizontal exit
- Adjacent to each public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor

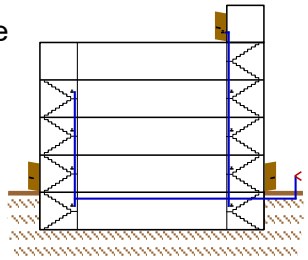
Hose valves not required when ≤130' from an exit stairway hose connection



154

Interconnection of Standpipes §905.4.2, §905.6.2

- Where ≥2 Class I or III standpipes are in the same building or area they must be interconnected
- NFPA 14 requires interconnection of standpipes at the top of th building when the water supply or tank is at the top



155

Location of Class II Hose Connections §905.5

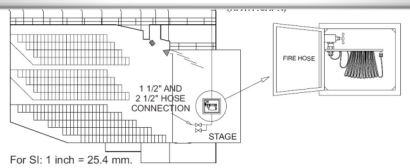
- Where Class II standpipe system is required throughout building, hose and valves must be accessible and distributed so all portions of the building are ≤100' hose with 30' hose stream
- Hose stations required in Group A-1 & A-2 occupancies with OL >1,000
  - Each side of stage
  - At rear of auditorium
  - Each side of balconies
  - Each tier of dressing rooms

156

Class III Standpipe at Stages

- Class III wet standpipe required at stages >1,000 ft²
- In
  re

Stage is a space in a building utilized for entertainment or presentations, and includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.



For SI: 1 inch = 25.4 mm.

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Purpose of a Fire Alarm and Detection System

A fire alarm and detection system can be designed to perform several functions:

- Providing notification of an emergency
- Monitoring and notification of supervisory and trouble signals
- Alerting the occupants
- Summoning aid
- Controlling fire safety functions

Photo courtesy of Siemens Building Systems Inc.

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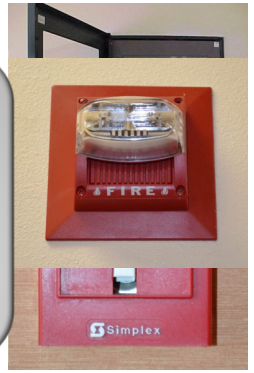
Fundamental Components of a Fire Alarm and Detection System

- Fire Alarm Control Unit

Receives inputs from automatic and manual fire alarm devices and may be capable of supplying power to detection devices and transponders or off-premises transmitters. The control unit may be capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.



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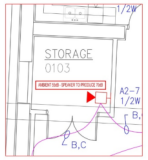
Fire Alarm Systems Requirements §907.2

- Must comply with NFPA 72, *National Fire Alarm Code*
- All components must be listed and approved
- Design audibility level must be shown on plans
- Where fire detection is required, smoke detection is 1st choice
- Where heat detection is required, fire sprinklers can substitute for heat detectors



161

Group A §907.2.1

- Manual fire alarm system required where OL ≥300

Group A-1, A-2, A-3 and A-4 will all require a fire sprinkler system when OL ≥300

When a required fire alarm system is installed in a building, ALL fire-extinguishing systems shall be monitored by FACU §904.3.5

162

Group A §907.2.1.1

- Emergency voice/alarm communication system is required in Group A with OL ≥1,000
- This system must be connected to a source of emergency power

163

Group B §907.2.2

- Manual fire alarm required where:
  - OL ≥500
  - ≥100 persons are located above or below LED
- In sprinklered buildings, manual fire alarm boxes can be eliminated except for one in an approved location

164

Group B Ambulatory Care Facility §907.2.2.1

- Manual fire alarm system required throughout the fire area containing an ACF
  - In sprinklered buildings, manual fire alarm boxes can be eliminated except for one in an approved location
- Smoke detection system required in ACF and all public areas including corridors and lobbies
  - Smoke detection can be eliminated in sprinklered buildings

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Group E §907.2.3

- Manual fire alarm system required where OL ≥50
- Emergency voice/alarm communication system required where OL >100
- Manual fire alarm boxes are not required where:
  - Interior corridors are protected by smoke detectors
  - Smoke or heat detection is provided in auditoriums, cafeterias and gyms
- Manual fire alarm boxes are not required where:
  - Building is sprinklered and EVAC will activate upon waterflow

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Group F §907.2.4

- Manual fire alarm required where:
  - ≥2 stories in height
  - OL ≥500 above or below the lowest LED
- In sprinklered buildings, manual fire alarm boxes can be eliminated except for one in an approved location

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Group H §907.2.5

- Manual fire alarm required in:
  - Group H-5
  - Group H-2 or H-3 that manufacture organic coatings
- Smoke detection system required where storing
  - Highly toxic gases
  - Organic peroxides
  - Oxidizers

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Group I
§907.2.6

- Manual fire alarm system required in all Group I
  - Manual fire alarm boxes are permitted to be located at constantly attended locations, as long as travel distances are maintained
- Smoke detection system shall be installed in corridors and waiting areas open to corridors Group I-1
  - Smoke detection not required in sprinklered Group I-1 Condition 1

169

Group I-2 Condition 1
§907.2.6.2

- In addition to manual system, smoke detection is required in corridors and areas open to corridors
  - Corridor detection not required where sleeping units have smoke detectors that notify at nursing station
  - Corridor detection not required
    where sleeping unit doors are equipped with smoke-detector- activated door-closing device

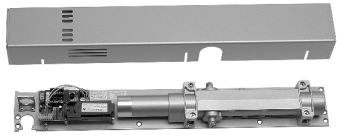


Photo courtesy of ASSA ABLOY Door Security Solutions

170

Group I-3
§907.2.6.3.3

- In addition to manual system, smoke detection system is required in housing areas, sleeping units, day rooms and other common spaces accessible to residents
  - Sleeping unit detectors not required in Group I-3 Use Condition 2 or 3
  - Sleeping unit detectors not required in where ≤4 residents and the building is sprinklered

171

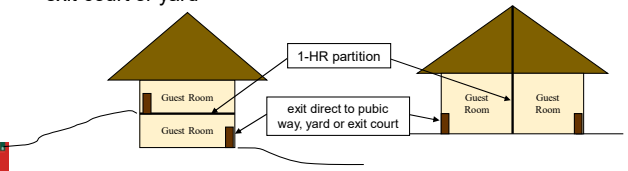
Group M
§907.2.7

- Manual fire alarm required where:
  - OL ≥500
  - ≥100 persons are located above or below LED
- Not required in covered or open malls
- In sprinklered buildings, manual fire alarm boxes can be eliminated except for one in an approved location
- Notification signal can go to normally attended location if emergency voice/alarm communication system is provided

172

Group R-1 §907.2.8.1

- Manual fire alarm system required
- Manual fire alarm system is ***NOT*** required where:
  - Building is ≤2 stories in height
  - Sleeping units, attics & crawl spaces have a minimum 1-HR separation
  - Each individual sleeping unit has an exit directly to a public way, exit court or yard



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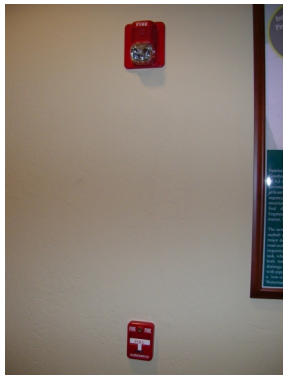
Group R-1 §907.2.8.1, Exc 2

- Manual fire alarm boxes are not required where:
  - Building is sprinklered with NFPA 13 or 13R
  - Notification appliances activate upon sprinkler flow
  - 1 manual fire alarm box is installed at an approved location



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Group R-1 §907.2.8.2

- Smoke detection required in interior corridors serving sleeping rooms
  - Detection system is not required where the sleeping units have means of egress door opening directly to an exterior exit access

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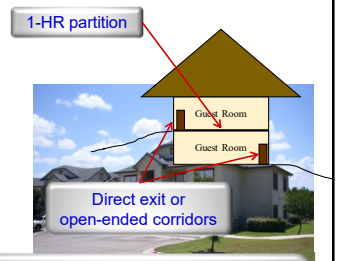
Group R-2 §907.2.9

- Manual fire alarm system required where:
  - Any dwelling unit is ≥3 stories above lowest LED
  - Any dwelling unit is located >1story below the highest LED
  - Building houses >16 dwelling units or sleeping units



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Group R-2 College & Univ. Buildings §907.2.9.3

- Smoke detection system is required in Group R-2 occupancies operated by a college or university for student or staff housing
  - Common spaces outside of dwelling and sleeping units
  - Laundry rooms, mechanical equipment rooms and storage rooms
  - Interior corridors serving sleeping or dwelling units

Detection system is not required in buildings without interior corridors

Smoke alarms in dwelling units and sleeping units SHALL be interconnected to fire alarm system

177

Group R-4 §907.2.10

- Manual fire alarm system is required
- Smok… …rridors, waitir… …and comn…

Manual fire alarm system is not required IF building ≤2-stories with 1-HR partitions separating all units and each unit has direct exit

Smoke detection is not required in buildings sprinklered with NFPA 13

Smoke detection is not required if no interior corridors serving sleeping units and unit has exit to exterior

sprinklered with NFPA 13 or 13R

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REFER TO CODE BOOK

2018 IFC §202 Page 47

Special Amusement Buildings

A special amusement building represents a high fire and life safety challenge based on its definition:

> A building that is temporary, permanent or mobile that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction as a form of amusement arranged so that the egress path is not readily apparent due to visual or audio distractions or an intentionally confounded egress path, or is not readily available because of the mode of conveyance through the building or structure.

179

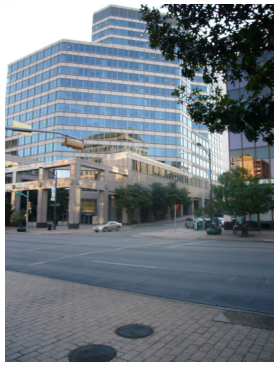
Special Amusement Buildings §907.2.11

- Smoke detection system required
  - Activate audible/visual alarms
  - Illuminate the means of egress
  - Shut off sound
  - Shut off visual distractions that confuse occupants
  - Activate approved directional exit marking
  - Activate pre-recorded message on emergency voice/alarm communication system

180

High-rise Buildings §907.2.12

- Smoke detection required in:
  - Air-handling systems
  - Mechanical equipment rooms
  - Elevator machine rooms
  - Elevator lobbies
- Emergency voice/alarm communication system required
- Emergency responder radio coverage
  - Fire department communication systems



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Emergency Voice/Alarm Communication Systems §907.5.2.2

- System to deliver voice instructions on the floor of fire origin and the floor above and below the floor of fire origin
- Speakers are required to be designed as dedicated paging zones:
  - Elevator groups
  - Exit stairways
  - Each floor
  - Areas of refuge

182

Fire Alarm System Zones §907.6.4

- Each floor is zoned separately
  - ≤22,500 ft², except for sprinkler systems
  - ≤300' in any direction
- In high-rise buildings each floor will have separate zones for:
  - Smoke detectors
  - Sprinkler water-flow devices
  - Manual fire alarm boxes
  - Other fire detection or suppression systems

183

Retroactive Fire Alarm Systems §1103.7

- If the following existing buildings do not have a fire alarm system, one must be installed:
  - Groups E, I-1, I-2, I-3, R-2
  - Group R-1 boarding and rooming houses
  - Group R-1 hotel and motel
  - Group R-4 residential care/assisted living facilities.
- Single- and multiple-station smoke alarms in Groups I-1 and R

184

Duct Smoke Detection §907.3.1

- When a fire alarm system is required, all extinguishing and detection systems must be connected to fire alarm system
- IMC §602 requires duct detection when:
  - Return air systems have a capacity >2,000 CFM
  - Common supply and return air systems have a capacity >2,000 CFM
  - Return air risers serving ≥2 stories have a design capacity >15,000 CFM

Photo courtesy of Air Products and Control, Inc.

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Poll Question

- Question #9: Duct Smoke Detectors are required to activate the Building Fire Alarm System?

186

Protection of Fire Alarm Control Unit §907.4.1

- When FACU is located in an area which is not in a continuously occupied area, it must be protected by:
  - A single smoke detector; or
  - A heat detector where ambient conditions are not favorable to smoke detectors
  - §907.4.3.1 states that a fire sprinkler can fulfill the service of a heat detector

187

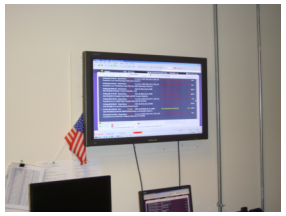
Manual Fire Alarm Boxes §907.4.2

- Manual fire alarm boxes must:
  - Be located ≤5' from each exit
  - Have an exit access travel distance to manual fire alarm box of ≤ 200'
  - Have an activation handle located 42-48" AFF
  - Be **red** in color
  - Be equipped with listed protective covers if ordered by the FCC

188

Occupant Notification Systems §907.5

- Notification appliances are required in most occupancies
  - Audible
  - Visual
  - Tactile
  - Any combination thereof
- Notification must occur upon activation of a fire detector, sprinkler flow, a manual fire alarm box or an automatic fire-extinguishing system



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Audible Alarms §907.5.2

- 15 dBA above ambient sound level
- Maximum sound pressure level permitted is 110 dBA
- Minimum required sound pressure level for all appliances and for certain areas of buildings

190

Visual Alarms §907.5.2.3.1

- Visu
  - P
  - C
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  audi
  notifi
  designed with a ≥20% spare
  capacity for future visual alarms

Number of Sleeping Units	
6 to 25	
26 to 50	
51 to 75	
76 to 100	
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

All dwelling units and sleeping units in Group R-2 shall be provided with the capability to support visible alarm notification appliances

191

Monitoring §907.6.6

- All required fire alarm systems to be monitored by an approved supervising station
- Supervision is not required for:
  - Smoke alarms or smoke detectors in Group I-3
  - Automatic sprinklers in 1- and 2-family dwellings
  - Smoke alarms

Photo courtesy of Property Protection Inc.

192

Inspection, Testing and Maintenance §907.8

- Acceptance testing of fire detection and alarm systems is required at time of installation
- Additional/routine testing in accordance with the schedules in NFPA 72
- Written records of the maintenance, inspection and testing
- Records to be maintained and made available to FCO upon request

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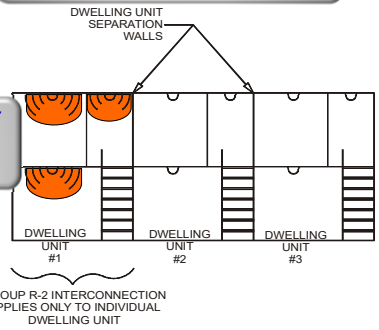
Where Smoke Alarms Are Required §907.2.10

A single- or multiple-station alarm which responds to smoke and is not connected to a system

- Smoke alarms are required in:
  - Groups R-1, R-2, R-3 R-4 and I-1
- Smoke alarms comply with UL 217
- Smoke detectors comply with UL 268

circuit with a battery backup power supply

- Interconnection when ≥1 device



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Smoke Alarms near Cooking Appliances and Bathrooms - §907.2.10.3, §907.2.10.4

- Criteria for locating smoke alarms in relation to cooking appliances
- Criteria for locating smoke alarms in relation to bathrooms
- Proper location of smoke alarms can help reduce the number of nuisance alarms

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Emergency Alarm Systems §908

- Emergency alarm systems required for:
  - Group H-5
  - Indoor storage & use areas of highly toxic or toxic gases as required by §6004.2.2.10
  - Ozone gas-generator rooms
  - Repair garages for vehicles fueled with a non-odorized gas
  - Refrigeration systems

Emergency alarms are systems to provide indication and warning of emergency situations involving hazardous materials

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Carbon Monoxide Alarms §915, §1103.9

- CO alarms required in:
  - Groups I-1, I-2, I-4 and R
  - Group E classrooms
- IF:
  - Fuel-burning appliances
  - Force air furnace with fuel-burning appliance
  - Attached private garage
- Could be CO alarm or CO detection system

Only retroactive for these occupancies

Public garages are regulated under IBC §406 and provided with ventilation

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Fire Alarm and Detection Systems

ACTIVITY

- What is the component in a fire alarm and detection system that recognizes a change of state or condition?

Alarm-initiating device §902.1

- What IFC chapter contains the retroactive requirements for fire alarm systems?

Chapter 11 Construction Requirements for Existing Buildings §1103.7

198

Fire Alarm and Detection Systems

ACTIVITY

3. Which occupancies/facilities require an emergency alarm/voice communications system?

Cover or open mall >50,000 ft² §914.2.3
Group A with OL >1,000 §907.2.1.2
Group E with OL >100 §907.2.3
Group A, E or M with atrium §907.2.13
High-rise buildings §914.3.5

4. T (F) CO alarms are required in all rooms of Group E occupancies.

Only in classrooms of Group E §915.1.1

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Module 7

Smoke Management

200

Smoke Management Systems §909, §910

- Two concepts of handling smoke in the code
  - §909 – Smoke Control Systems
  - §910
- These
  - Both
  - Smoke Control System's main function is for life safety

These systems are designed to

These systems are designed to remove smoke from buildings in large Group F and S occupancies

enhance fire-f
age

201

Required Smoke Control Systems

- IBC §402.7.2 – covered malls constructed as an atrium >2 stories in height
- IBC §404.5 – atriums
- IBC §405.5 – underground buildings
- IBC §408.9 – windowless buildings
- IBC §410.2.7.2 – stage >1,000 ft²
- §1029.6.2.1 – smoke-protected assembly seating
- §1023.11 – smokeproof enclosures

202

Types of Smoke Control Systems

- 3 methods of smoke control:
  - Smoke barrier construction – can be either active or passive
  - Pres
  - Ex

- These systems are engineered for a specific building and specific purpose
- Each system will have distinct components and design
- Systems need to be commissioned and inspected in accordance with the design documents

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203

Smoke and Heat Removal

- Smoke and heat removal required in:
  - Group F-1 and S-1 >50,000 ft²
  - High-piled storage where required by Table 3206.2
- A smoke and heat removal can be accomplished by eith
  - Sm
  - Me

Not required:
- In frozen food warehouses with Class I or II commodities
- Where ESFR sprinklers are installed
- Where CMSA sprinklers with RTI ≤50 are installed

204

Smoke and Heat Removal §910

- Selection of smoke & heat removal method

Method of Smoke & Heat Removal	Sprinklered Building	Nonsprinklered Building	1st Story with Stories Above
Smoke/Heat Vents	Option 1	Required	Not allowed
Mechanical Smoke Removal	Option 2	Not allowed	Required

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Smoke/Heat Vents

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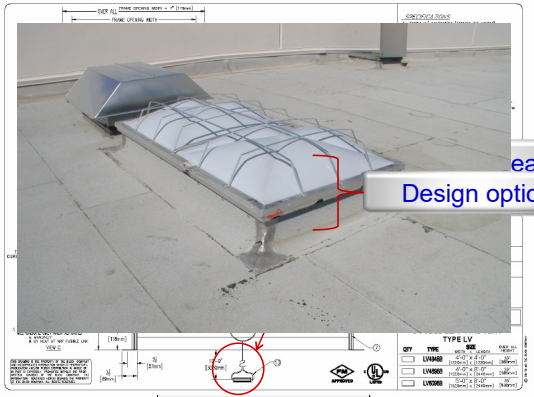

Design option

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Photo courtesy of Bilco Corporation

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Smoke and Heat Removal §910

- Smoke/heat vents
  - Calculation for sprinklered building
    - $A_{VR} = V/9000$
  - Calc
    - A_{V}

NOTE: formula is based on volume; no longer based on floor area

- A_{VR} = the aggregate vent area required
- V = the volume of the area to be vented

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FOR EXAMPLE

Smoke/Heat Vents

- Calculation for sprinklered building
  - 400,000 ft² warehouse
  - Ceiling/roof height = 36’
  - 400,000 x 36 = 14,400,000 ft³
  - 14,400,000 ÷ 9,000 = 1,600 ft² of vent area
  - 4’ x 8’ Smoke/heat vent = 32 ft²
  - 1,600 ÷ 32 = 50 vents

$A_{VR} = V \div 9000$

Photo courtesy of Bilco, Inc.

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Smoke and Heat Removal §910

- Mechanical smoke removal
  - 2 air changes per hour
  - Based on empty building
  - Makeup air openings ≤6' of floor
  - Automatic shutdown upon sprinkler operation
  - Manual controls in room accessible from the exterior with 1-HR separation

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ACTIVITY

Smoke/Heat Vents

Given:

- Building area: 65,000 ft²
- Storage Height: 21'
- Ceiling Height: 27'
- High-piled Storage: Yes
- Commodity: Class IV
- Area of each smoke and heat vent: 32 ft²
- Building is sprinklered

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ACTIVITY

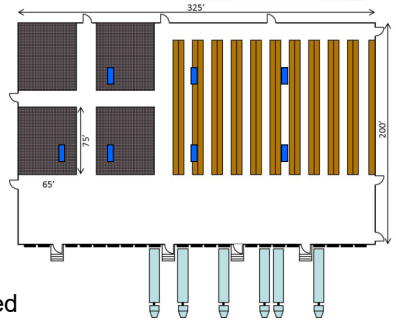
Smoke/Heat Vents

Is this design acceptable?

Determine smoke/heat vent requirements

$A_{VR} = V \div 9000$

- Volume = 65,000 X 27
- Volume = 1,755,000 ft³
- $A_{VR} = V \div 9000$
- A_{VR} = 1,755,000 ÷ 9000
- A_{VR} = 195 ft²
- Smoke/heat vent = 32 ft²
- 195 ÷ 32 = 6.09 vents
- Therefore 7 vents required



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Smoke/Heat Vents §910.3

- Vents listed to UL 793 or FM 4430
- Gravity drop out vents must operate after a 5-minute exposure to temperature of 500°F
- Activation temperature is not specified in the IFC
  - FM specifies that vents should be ≤100°F above the sprinkler operating temperature
- Smoke/heat vents ≥16 ft²
- Located ≥20' from property lines and ≥10' from fire barriers or fire walls

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ACTIVITY

Mechanical Smoke Removal

Given:

- Building area: 65,000 ft²
- Storage Height: 21’
- Ceiling Height: 27’
- High-piled Storage: Yes
- Commodity: Class IV
- Exhaust fans rated at 30,000 CFM
- Building is sprinklered

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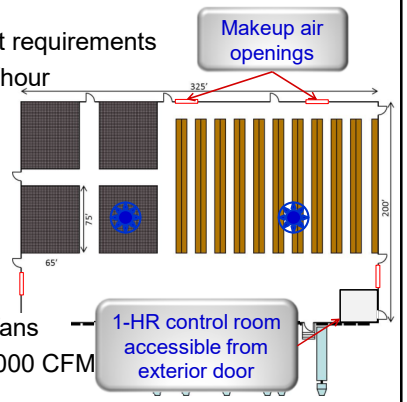
ACTIVITY

Mechanical Smoke Removal

Determine smoke/heat vent requirements

Ventilation = 2 air changes/hour

- Volume = 65,000 X 27
- Volume = 1,755,000 ft³
- CFH = 2 X 1,755,000
- CFH = 3,510,000 ft³
- CFM = 3,510,000 ÷ 60
- CFM = 58,500
- 58,500 ÷ 30,000 = 1.95 fans
- Makeup air = 8 ft² per 1,000 CFM
  293 ft² required



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Discussion Activity

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Fire Protection During Construction

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Final Reflection

Reflect on the day. What will you take back to the job and apply?

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn? What difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?

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